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Banana (Musa Acuminata X Balbisiana) Pseudo Stem Flour as an Alternative in Pasta Making

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ABSTRACT: This study aims to identify more sustainable sources of accessible flour for pasta manufacture, given the Philippines' reliance on wheat imports. Additionally, the project aims to reduce agricultural waste from banana fields during harvest. The study explored to find out the possible strategy for the development of banana (Musa acuminata x balbisiana) pseudo-stem flour as an alternative flour to pasta making. Therefore, the study includes three parts, with the first drying of the banana pseudo stem flour using a dehydrator and grinding it, the second making of pasta and cooking into different pasta recipes, third using a survey method to determine the acceptability of the developed pasta used in two pasta recipes: tuna carbonara and Filipino style spaghetti. The respondents described the banana pseudo stem flour pasta used in tuna carbonara as highly acceptable with an overall mean of 4.65 and 4.54 for taste and aroma while in terms of texture (4.13), color (4.02), and appearance (4.17) were moderately acceptable. Additionally, the taste (4.67) and aroma (4.64) of the banana pseudo stem flour pasta used in Filipino-style spaghetti are highly accepted by the respondents while in terms of texture (4.17), color (4.04) and appearance (4.18) were moderately acceptable. According to the data, banana pseudo-stem flour has the potential to be a widely used component in pasta recipes and across a variety of demographics, with adults, teenagers, and food experts endorsing it very strongly. The shelf life of banana pseudo stem flour pasta is 2 days while the flour is until 45-60 days. The banana pseudo stem flour pasta contains ash 0.70% w/w, carbohydrate, 23.53% w/w, crude fat 0.76 % w/w, crude protein 3.95% w/w, moisture 71.74% w/w, and energy 119 kcal.

KEYWORDS: Banana Pseudo Stem Flour, Pasta, Musa Acuminata X Balbisiana, Alternative Flour, Sensory Evaluation

INTRODUCTION

Around the world, pasta is growing in popularity as a food, and many new recipes have been developed to increase its nutritional content. Flour is finely grounds cereal grains or other starchy portions of plants, used in various food products and as a basic ingredient of baked goods. Durum wheat semolina is commonly used flour in pasta making. Pasta is a stable food product that is produced mainly by mixing durum wheat semolina and water. Gluten consists of gliadin and glutenin and is responsible for elasticity and al dente chewability of pasta, which is highly appreciated by consumers (Sozer, 2009).

The Philippines' reliance on wheat imports and the rising cost of wheat on the world market have a detrimental effect on consumers' ability purchase. Thus, resolving these challenges will be made easier with the availability of accessible flours and other, more sustainable sources (Alviola & Monterde, 2018). The country does not produce wheat flour which is the main ingredients in pasta making. Thus, using alternative flour in pasta making is important in developing country like the Philippines.

Bananas are one of the most common fruits being consumed by the Filipinos. It is well-known that Filipinos are able to produce different varieties of food that uses banana as the main ingredient. Filipinos produce sweetened banana on sticks locally known as Banana-cue. Other desserts are Banana con Yelo, Nilupak na saging, and Banana Fritter (Maruya). It can also be used to create pastries like Banana Bread, Banana Cake, and Banana cookies.

In the town of Alfonso Lista, Ifugao, banana is an industry because bananas are widely consumed and has a large contribution in the economic development of the town. Due to the abundance of the Alfonso Lista's Banana resources, it became one of the main sources of income of the people. Every harvest, numerous banana "stems" are left in the field, harming the environment and harboring biological microbes.

Each banana tree produces a single bunch of bananas. Banana pseudo stems constitute agricultural trash after harvest, leading to economic loss and environmental concerns. (Ma, 2015). The global output of pseudo stem as post-harvest trash is currently at 336 million tons, or 60–70 tons per hectare. It's essentially useless and contributes to pollution. (Islam et.al 2021).

On the other hand, banana pseudo stem is high in nutritional fiber and have health benefits. In comparison to commercial supplements, pseudo stems had a higher ratio of soluble to insoluble dietary fiber. The neutral sugars detected in pseudo stems were

glucose, mannose, and xylose, whereas xylose, arabinose, and mannose were found in commercial supplements and served distinct objectives than pseudo stem fiber. (Ma, 2015)

The purpose of this study is to determine whether banana pseudo stem flour may be used as an alternative for pasta making. After harvest, farmers in Alfonso Lista, Ifugao area leave the banana pseudo stems on the farm to rot, therefore this study explore potential uses for the aforementioned bio-waste. It is also required to determine its acceptability in the following parameters; appearance, aroma, color, taste and texture throughout this study. This study also determines if the Banana Pseudo Stem Flour Pasta can be used in different kinds of recipes. The samples are subjected for proximate analysis and shelf life of the product. The findings of this study are relevant to the community since, as we can see, a banana dies back after bearing fruit instead of letting the stem die or being thrown away, we could use it for something useful and be benefited with its high nutrition content. Also, the study is in line with the SDG's including the following: (1) Climate action, reduce post-harvest trash from banana farms that contributes to pollution. (2) Zero hunger the study utilized banana pseudo stem which is high in dietary fiber to combat malnutrition. (3) Decent work and economic growth the study utilizes banana pseudo stem and turn them into a value-added product which is the pasta for additional income sources, hence providing sustainable economic growth and decent work.

RESEARCH QUESTIONS

This study aimed to develop Banana pseudo-flour Pasta as an Alternative to Pasta Making and determine its acceptability:

- 1. What is the process of preparing banana pseudo-stem flour?
- 2. What is the process of preparing banana pseudo-stem flour pasta to be used in the following recipes:
 - a. Tuna Carbonara
 - b. Filipino Style Spaghetti
- 3. What is the level of acceptability of pasta carbonara and Filipino-style spaghetti with banana pseudo-stem flour in terms of:
 - a. Appearance/color;
 - b. Aroma;
 - c. Taste; and
 - d. Texture?
- **4.** What is the general level of acceptability of Banana Pseudo Stem flour in pasta making used in different recipes as evaluated by different groups of respondents?
 - a. Children;
 - b. Teenagers;
 - c. Adults; and
 - d. Food Experts?
- 5. Is there a significant difference in the general level of acceptability of pseudo-stem flour pasta in using different recipes across varied groups of respondents?
- 6. What is the nutritive value of the banana pseudo-stem flour pasta?
- 7. What is the shelf life of pseudo-stem flour and pasta at normal room temperature?

METHODOLOGY

Materials

Table 1. Tools and Equipment used in the preparation of banana pseudo stem flour pasta in pasta making.

| Preparatory tools | Measuring tools | Mixing tools | Cutting tools | Cooking tools | Equipment |
|-------------------|-----------------|--------------|----------------|---------------|---------------------------|
| Flour Sifter | Measuring Cups | Mixing Bowls | Knife | Gas Range | Pasta Maker |
| Colander | Measuring Spoon | Wooden spoon | Scissors | Pots | Dough Cutter |
| Spatula | Weighing Scale | Whisk | Chopping Board | Ladle | Blender |
| Utility Tray | | | Dough Cutter | Pans | Dehydrator/Drying Machine |
| Grater | | | | | Dough Roller |
| | | | | | Food Processor |

Ingredients

Table shows the ingredients use in the production of banana pseudo stem flour as an alternative for pasta making.

Table 2. Ingredients in Banana Pseudo Stem Flour Pasta

| Ingredients | Measurement | |
|--------------------------|-------------|--|
| Banana Pseudo Stem Flour | 250 grams | |
| All-purpose Flour | 125 grams | |

| Cornstarch | 125 grams |
|------------|----------------|
| Water | 89 milliliters |
| Egg | 50 grams |

The table below shows the different ingredients used in the preparation of banana pseudo-stem flour in different recipes.

Table 3. Ingredients in the Preparation of Banana Pseudo Stem Flour Pasta into Tuna Carbonara

| Ingredients | Measurement | |
|-------------------|-------------|--|
| Pasta | 250 grams | |
| All-purpose cream | 315 grams | |
| Milk | 315 grams | |
| Garlic (Minced) | 30 grams | |
| Black Pepper | 6 grams | |
| Onion (Minced) | 50 grams | |
| Butter | 125 grams | |
| Cheese | 70 grams | |
| Salt | 12 grams | |
| Canned tuna | 155 grams | |
| Mushroom | 190 grams | |

Table 4. Ingredients in the Preparation of Banana Pseudo Stem Flour Pasta into Spaghetti

| Ingredients | Measurement |
|-------------------------|-------------|
| Pasta | 250 grams |
| Spaghetti Sauce | 900 grams |
| Ground Beef | 200 grams |
| Onion (Minced) | 30 grams |
| Garlic (Minced) | 30 grams |
| Hotdog (Sliced) | 100 grams |
| Shredded Cheddar Cheese | 125 grams |
| Salt | 6 grams |
| Black Pepper | 6 grams |
| Sugar | 15 grams |
| Cooking oil | 15 grans |
| Beef Broth | 250 grams |

Developmental Procedure: To perform the research properly, the flowchart (fig.1) of the procedure for making banana pseudo stem flour pasta was followed consistently. This study used banana pseudo stem as the main ingredient.



Figure 1. The Flow diagram of the Procedure in making Banana Pseudo Stem Flour Pasta

Preparation of Banana Pseudo Stem Flour

To prepare the flour, the outer skin layer of the banana pseudo stem was peeled manually, followed by washing it under running tap water. Then sliced into thin pieces. Next, dry using a food dehydrator or a drying machine at 50°C for 48 hours. (Chakraborty, et al. 2021) A kitchen blender was used to grind the dried pseudo stem and pass through a sieve. The yield banana pseudo stem flour is kept into an airtight container and store at ambient temperature prior to production of banana pseudo stem flour pasta.

Preparation of Banana Pseudo Stem Flour Pasta

The banana pseudo-stem flour is processed into pasta using the standard proportion of ingredients as stated in Table 3. The dough was kneaded using the heel of the hands just enough for the desired firmness of the pasta. The dough is flattened using a rolling pin or dough roller, not too thick but not too thin either. Next, the flattened pasta is cut through a pasta maker. Then, hang the pasta on a pasta drying rack before cooking. Then store in an airtight container or standard packaging materials.

After the preparation of banana pseudo stem flour into pasta, the preparation of different recipes like tuna carbonara and Filipino style spaghetti shall be done.

Sensory Evaluation

The finished products were subjected to sensory evaluation. Sixty respondents from different age groups were selected through purposive sampling. The respondents are oriented by the researcher on how to evaluate the products using the scorecard. Respondents evaluated the pasta product's sensory parameters; appearance, aroma, color, taste, and texture.

Measurement of Shelf Life

The shelf-life was measured by packaging a sample of the banana pseudo-stem flour pasta in a polyethylene (PE) pouch, sealed with a vacuum sealer, and kept at room temperature. The pasta is considered spoiled when visible molds appear (Lordi, A., et al. 2023). The shelf-life of the banana pseudo stem flour is measured by packaging a sample of the flour into a polyethylene (PE) pouch, sealed with a vacuum sealer, and kept at room temperature.

Measurement of Nutritional Content

The banana pseudo-stem flour pasta was submitted for proximate analysis at the Department of Science and Technology-CAR testing center. The following parameters are measured: Ash, Crude Fat, Crude Protein, Moisture, Total Carbohydrates and Energy.

RESULT AND DISCUSSION

A. Processes in Preparing Banana Pseudo Stem

| Raw Material | Yield |
|---|--------------------------------------|
| 1.5 kilogram cleaned banana pseudo stem flour pasta | Approximately: 532.35 grams of flour |

The process of banana pseudo-stem flour is based on the study of Chakraborty, et al (2021). First, the banana pseudo stem is harvested, and the banana should be matured and ready for harvest. Second, the outer skin layer of the banana pseudo stem is peeled manually, followed by washing under running tap water. Then sliced into thin pieces. Next, dry using a food dehydrator set at 50°C for 48 hours. A kitchen blender and food processor are used to grind the dried pseudo stem and pass through a fine sieve. The yield banana pseudo stem is kept in a polyethylene bag and sealed with a vacuum sealer for longer storage.



Figure 2. Banana Pseudo Stem Flour

B. Processes of Preparing Banana Pseudo Stem Flour Pasta

| i 0 | | | | |
|--------------------------|----------------|------------------------------------|--|--|
| Ingredients | Measurement | Yield | | |
| Banana Pseudo Stem Flour | 250 grams | Approximately: 650 grams of fresh | | |
| All-purpose Flour | 125 grams | pasta | | |
| Cornstarch | 125 grams | Serving size: 110g of cooked pasta | | |
| Water | 89 milliliters | | | |
| Egg | 50 grams | | | |

The banana pseudo-stem flour is processed into pasta using the standard proportion of ingredients as stated in the table above. The dough was kneaded using the heel of the hands just enough for the desired firmness of the pasta. The dough is flattened using a dough roller, not too thick but not too thin either. Next, the flattened pasta is cut through a pasta maker. Then, hang the pasta on a pasta drying rack before storing it. Then store in an airtight container or standard packaging materials.



Figure 3. Banana Pseudo Stem Flour Pasta

C. Process in preparing banana pseudo stem flour pasta into various pasta recipes

a) Tuna Carbonara

| Ingredients | Measurement | Serving Size | | |
|-------------------|-------------|----------------------|--|--|
| Pasta | 250 grams | 110 grams per person | | |
| All-purpose cream | 315 grams | | | |
| Milk | 315 grams | | | |
| Garlic (Minced) | 30 grams | | | |
| Black Pepper | 6 grams | | | |
| Onion (Minced) | 50 grams | | | |
| Butter | 125 grams | | | |
| Cheese | 70 grams | | | |
| Salt | 12 grams | | | |
| Canned tuna | 155 grams | | | |
| Mushroom | 190 grams | | | |

Boil banana pseudo stem flour pasta for 5 mins or until tender. Sauté onion and garlic in butter. Add canned tuna and mushrooms. Then add all-purpose cream and milk. Simmer for 2 minutes. Season with salt and pepper. Toss in cooked banana pseudo stem flour pasta into the sauce. Transfer to a plate and top with grated cheese.



Figure 4. Banana Pseudo Stem Flour Pasta used in Tuna Carbonara

b) Filipino Style Spaghetti

| Ingredients | Measurement | Serving Size | | |
|-------------------------|-------------|------------------------------|--|--|
| Pasta | 250 grams | 110 gras of pasta per person | | |
| Spaghetti Sauce | 900 grams | | | |
| Ground Beef | 200 grams | | | |
| Onion (Minced) | 30 grams | | | |
| Garlic (Minced) | 30 grams | | | |
| Hotdog (Sliced) | 100 grams | | | |
| Shredded Cheddar Cheese | 125 grams | | | |
| Salt | 6 grams | | | |
| Black Pepper | 6 grams | | | |
| Sugar | 15 grams | | | |
| Cooking oil | 15 grans | 7 | | |
| Beef Broth | 250 grams | 7 | | |

Boil banana pseudo stem flour pasta for 5 minutes or until tender. Sauté garlic and onion in oil. Add beef and cook until the color turns light brown. Add hotdog and stir-cooked for 2 to 3 minutes. Pour in spaghetti sauce and beef broth. Simmer for 5 minutes. Add sugar, salt and pepper to taste. Toss in cooked banana pseudo stem flour pasta into the sauce. Transfer to a plate and top with grated cheese.



Figure 5. Banana Pseudo Stem Flour Pasta used in Filipino Style Spaghetti

D. Product Evaluation

Table 5. Level of Acceptability of Banana Pseudo Stem Flour Pasta as Alternative to Pasta Making in Using Different Recipes

| Characteristics | | Tuna Carbonara | | Filipino Style Spaghetti | |
|--|------|-------------------|------|--------------------------|--|
| Appearance | Mean | Description | Mean | Description | |
| The product is palatable | 4.48 | Highly Acceptable | 4.32 | Highly Acceptable | |
| The product has an attractive appearance | 3.92 | Moderately | 4.10 | Moderately Acceptable | |
| | | Acceptable | | | |
| The product can be a substitute for | 4.30 | Highly Acceptable | 4.23 | Highly Acceptable | |
| commercial pasta | | | | | |
| The product is comparable to another pasta | 4.17 | Moderately | 4.13 | Moderately Acceptable | |
| | | Acceptable | | | |
| The product's overall appearance is enticing | 4.00 | Moderately | 4.13 | Moderately Acceptable | |
| | | Acceptable | | | |
| Overall Mean | 4.17 | Moderately | 4.18 | Moderately Acceptable | |
| | | Acceptable | | | |
| Aroma | Mean | Description | Mean | Description | |
| The aroma is subtle | 4.65 | Highly Acceptable | 4.73 | Highly Acceptable | |
| The finished product smells good | 4.65 | Highly Acceptable | 4.70 | Highly Acceptable | |
| The aroma is detectable | 4.20 | Highly Acceptable | 4.40 | Highly Acceptable | |
| The other ingredients' aroma is tolerable | 4.53 | Highly Acceptable | 4.63 | Highly Acceptable | |
| The overall aroma is desirable | 4.62 | Highly Acceptable | 4.70 | Highly Acceptable | |
| Overall Mean | 4.54 | Highly Acceptable | 4.64 | Highly Acceptable | |
| Color | Mean | Description | Mean | Description | |
| The color is appealing to the eye | 3.92 | Moderately | 3.98 | Moderately Acceptable | |
| | | Acceptable | | | |
| The color is suited for pasta | 4.10 | Moderately | 3.95 | Moderately Acceptable | |
| | | Acceptable | | | |
| The color looks fresh | 3.98 | Moderately | 4.00 | Moderately Acceptable | |
| | | Acceptable | | | |
| The color is enticing | 4.00 | Moderately | 4.08 | Moderately Acceptable | |
| | | Acceptable | | | |
| The overall color is acceptable | 4.13 | Moderately | 4.18 | Moderately Acceptable | |
| | | Acceptable | | | |
| Overall Mean | 4.02 | Moderately | 4.04 | Moderately Acceptable | |
| | | Acceptable | | | |
| Texture | Mean | Description | Mean | Description | |
| The product has a good texture | 4.10 | Moderately | 4.12 | Moderately Acceptable | |
| | | Acceptable | | | |

| Banana (Musa Acuminat | a X Balbisiana) Pseudo Stem Fl | lour as an Alternative in Pasta Making |
|-----------------------|--------------------------------|--|
|-----------------------|--------------------------------|--|

| The product is comparable to commercial | 4.00 | Moderately | 3.98 | Moderately Acceptable |
|---|------|-------------------|------|-----------------------|
| pasta | | Acceptable | | |
| The product is light and fluffy | 4.00 | Moderately | 4.10 | Moderately Acceptable |
| | | Acceptable | | |
| The texture is consistent from the surface to | 4.20 | Highly Acceptable | 4.40 | Highly Acceptable |
| the inner part | | | | |
| The overall texture is highly acceptable | 4.28 | Highly Acceptable | 4.30 | Highly Acceptable |
| Overall Mean | 4.13 | Moderately | 4.17 | Moderately Acceptable |
| | | Acceptable | | |
| Taste | Mean | Description | Mean | Description |
| The taste of the product is acceptable | 4.63 | Highly Acceptable | 4.70 | Highly Acceptable |
| The taste is detectable | 4.45 | Highly Acceptable | 4.50 | Highly Acceptable |
| The taste of the other ingredients is present | 4.67 | Highly Acceptable | 4.48 | Highly Acceptable |
| The product is with aromatic taste | 4.72 | Highly Acceptable | 4.70 | Highly Acceptable |
| The taste of the product is exquisite | 4.80 | Highly Acceptable | 4.78 | Highly Acceptable |
| Overall Mean | 4.65 | Highly Acceptable | 4.67 | Highly Acceptable |

The table presents the acceptability of Banana pseudo-stem flour Pasta (BPSFP) as an alternative to conventional pasta in Tuna Carbonara and Filipino-style spaghetti based on various sensory attributes such as appearance, aroma, color, texture, and taste.

For Tuna Carbonara, the overall score indicates that the appearance of BPSFP is positively received, with participants moderately accepting that it looks good enough to be a viable alternative to traditional pasta with a mean score of 4.17. This indicates that the BPSFP used in Tuna Carbonara is generally well-received in terms of appearance with strong potential as a substitute for commercial pasta, and that the product is generally appealing and visually attractive.

In terms of its Aroma, the overall mean score of 4.54 indicates that participants have a very positive perception of the aroma of BPSFP. Furthermore, the participants *highly accepted* the overall aroma of the finished product is desirable and subtle. The high acceptability across all criteria shows that the pasta's scent is a significant strength, contributing greatly to its acceptability and appeal.

With regard to its Color, the participants moderately accepted the color of the Tuna Carbonara is visually attractive and pleasant to look at. The overall mean score of 4.02 implies that the product is visually appealling and aligning well with their expectation for pasta dishes.

Regarding its Texture, the overall mean score of 4.13 indicates that the participants *moderately accepted* the consistency of texture. This means that the tuna carbonara was found by the participants to be satisfactory and acceptable, with agreement on its consistency and overall quality.

Taste is the most positively rated attribute of the Tuna Carbonara indicating strong consumer preference and acceptability. The overall mean score of 4.65 reflects strong consensus among participants regarding the taste with all criteria receiving high acceptability, indicating exceptional satisfaction with its flavor profile.

Also, as gleaned from the table, the data suggests that the banana pseudo-stem pasta flour is widely accepted as an alternative to making Filipino-style spaghetti. The high ratings across all characteristics indicate a positive perception of the product's quality and suitability for this culinary application.

Specifically, in terms of Appearance, the respondents *moderately accepted* the product made with banana pseudo stem pasta flour is palatable, has an attractive appearance, can substitute commercial pasta effectively, and is comparable to other pasta options. The overall mean for appearance is high at 4.18, indicating general agreement. As to its Aroma, the participants also *highly accepted* the aroma of the banana pseudo stem pasta flour product is subtle, pleasant, detectable, and desirable. The overall mean for aroma is notably high at 4.64, indicating a strong consensus on its positive scent. While the color aspect received slightly lower ratings compared to aroma and appearance, it's still generally agreed upon that the color is appealing, fresh, and suited for pasta. The overall mean for color is 4.04, indicating *moderately acceptable* with the color's acceptability. Likewise, the respondents *moderately accepted* the products' texture, which is comparable to commercial pasta, and is light and fluffy. Moreover, they highly accepted the texture is consistent throughout the product and highly acceptable overall. The overall mean for texture is 4.17, indicating general satisfaction with the texture. The Taste aspect received the highest ratings among all characteristics. Participants *highly accepted* the taste of the product as acceptable, detectable, aromatic, and exquisite. The overall mean for taste is exceptionally high at 4.67, indicating a very strong consensus on the product's taste.

The study found that banana pseudo stem pasta flour is palatable, visually appealing, and has a pleasant aroma, color, texture, and taste, making it a viable substitute for traditional commercial pasta in Filipino-style spaghetti, indicating high consumer acceptability and satisfaction.

The above findings are supported by the study conducted by Go et al (2021), wherein the result of their study shows that the brownies made of banana pseudo stem flour were highly acceptable to the consumers. While in the study of Thorat et al (2018), the banana pseudo stem can be used in a powdered form that can be a value-added food product to bakery products.

| Table 6. The Level of Acceptability of Banana Pseud | lo Stem Flour for Past | a Making in U | sing Different | Recipes A | According |
|---|------------------------|---------------|----------------|-----------|-----------|
| to Varied Groups | | | | | |

| Respondents | Characteristics | Tuna Carbon | ara | Filipino Style Spaghetti | | |
|---------------------|--|-------------|-------------------|--------------------------|-------------------|--|
| | | Mean | Description | Mean | Description | |
| Children | Appearance | 3.75 | Moderately | 3.87 | Moderately | |
| | | | Acceptable | | Acceptable | |
| | Aroma | 4.35 | Highly Acceptable | 4.45 | Highly Acceptable | |
| | Color | 3.47 | Moderately | 3.63 | Moderately | |
| | | | Acceptable | | Acceptable | |
| | Texture | 3.91 | Moderately | 3.99 | Moderately | |
| | | | Acceptable | | Acceptable | |
| | Taste | 4.77 | Highly Acceptable | 4.67 | Highly Acceptable | |
| Overall Mean | | 4.05 | Moderately | 4.12 | Moderately | |
| | | | Acceptable | | Acceptable | |
| Teenagers | Appearance | 4.31 | Moderately | 4.27 | Highly Acceptable | |
| | | | Acceptable | | | |
| | Aroma | 4.53 | Highly Acceptable | 4.57 | Highly Acceptable | |
| | Color | 4.21 | Highly Acceptable | 4.15 | Moderately | |
| | | | | | Acceptable | |
| | Texture | 4.33 | Highly Acceptable | 4.32 | Highly Acceptable | |
| | Taste | 4.59 | Highly Acceptable | 4.73 | Highly Acceptable | |
| Overall Mean | I Mean 4.39 Highly Acceptable 4.41 Highly Ac | | Highly Acceptable | | | |
| Adults | Appearance | 4.51 | Highly Acceptable | 4.56 | Highly Acceptable | |
| | Aroma | 4.68 | Highly Acceptable | 4.73 | Highly Acceptable | |
| | Color | 4.33 | Highly Acceptable | 4.48 | Highly Acceptable | |
| | Texture | 4.39 | Highly Acceptable | 4.55 | Highly Acceptable | |
| | Taste | 4.61 | Highly Acceptable | 4.71 | Highly Acceptable | |
| Overall Mean | | 4.50 | Highly Acceptable | 4.62 | Highly Acceptable | |
| Food | Appearance | 4.13 | Moderately | 4.04 | Moderately | |
| Experts | | | Acceptable | | Acceptable | |
| | Aroma | 4.59 | Highly Acceptable | 4.79 | Highly Acceptable | |
| | Color | 4.08 | Moderately | 3.91 | Moderately | |
| | | | Acceptable | | Acceptable | |
| | Texture | 3.89 | Moderately | 3.84 | Moderately | |
| | | | Acceptable | | Acceptable | |
| | Taste | 4.64 | Highly Acceptable | 4.59 | Highly Acceptable | |
| Overall Mean | | 4.27 | Highly Acceptable | 4.23 | Highly Acceptable | |

The table exhibits the level of acceptability of banana pseudo stem flour for pasta making across different recipes and age groups.

For both Tuna Carbonara and Filipino Style Spaghetti, children generally found the banana pseudo stem flour pasta moderately accepted the product across all characteristics, with mean scores ranging from 3.47 to 4.77. While the scores are generally lower compared to other age groups, they still fall within the "moderately acceptable" to "highly acceptable" range, indicating overall acceptance among children.

Teenagers consistently rated the banana pseudo stem flour pasta very positively across all characteristics and recipes, with mean scores ranging from 4.15 to 4.73. They particularly showed strong agreement regarding aroma, texture, and taste. Overall, teenagers found the banana pseudo-stem flour pasta highly acceptable.

Adults also rated the banana pseudo-stem flour pasta very positively, with mean scores ranging from 4.33 to 4.71. Similar to teenagers, they showed strong agreement across all characteristics, indicating high acceptability of the product. Adults consistently found the banana pseudo-stem flour pasta highly acceptable across different recipes.

Food experts, as expected, provided a more critical evaluation. However, they still rated the banana pseudo stem flour pasta positively, with mean scores ranging from 3.84 to 4.79. They particularly emphasized the aroma and taste, where they showed strong agreement. Overall, food experts found the banana pseudo-stem flour pasta to be highly acceptable for both recipes.

Results indicate that across all age groups and recipes, the banana pseudo stem flour pasta received generally positive ratings, with mean scores indicating moderately acceptability or high acceptability in terms of appearance, aroma, color, texture, and taste. Moreover, the teenagers, adults, and food experts consistently rated the banana pseudo stem flour pasta very positively, showing high acceptability across different recipes. Children, while slightly lower in their ratings compared to other groups, still found the banana pseudo-stem flour pasta moderately acceptable.

The results of the study are supported by the study of Fugaban (2021), wherein the banana pseudo stem developed into bola-bola, siomai, and burger patty were acceptable among different groups of respondents.

The data suggests that banana pseudo-stem flour has the potential to be a widely accepted ingredient for making pasta across different age groups and recipes, with particularly strong endorsement from teenagers, adults, and food experts.

 Table 7. Comparison in the General Level of Acceptability of Banana Pseudo Stem Flour Pasta Making in Different Among

 Varied Groups of Respondents

| Recipes | F-Value | ρ-Value | Decision | Remarks |
|--------------------------|---------|---------|-----------------------|-------------|
| Tuna Carbonara | 3.1344 | 0.0325 | Reject H ₀ | Significant |
| Filipino Style Spaghetti | 5.0120 | 0.0038 | Reject H ₀ | Significant |

The table presents a comparison in the level of acceptability of Banana Pseudo Stem Flour Pasta making among varied age groups of respondents for two recipes: Tuna Carbonara and Filipino Style Spaghetti.

For Tuna Carbonara as a product, the F-value is 3.1344 with a ρ -value of 0.0325. Since the p-value is less than the significance level of 0.05, the null hypothesis (H₀) is rejected. This indicates that there are significant differences in the level of acceptability of Tuna Carbonara among different age groups. Therefore, the age group plays a significant role in determining the acceptability of Tuna Carbonara made with Banana Pseudo Stem Flour Pasta.

For Filipino-style spaghetti as a product, the F-value is 5.0120 with a p-value of 0.0038. Similar to Tuna Carbonara, since the ρ -value is less than 0.05, the null hypothesis is rejected. This suggests significant differences in the level of acceptability of Filipino-style spaghetti among different age groups. Thus, the age group also significantly influences the acceptability of Filipino-style spaghetti made with Banana pseudo-stem flour Pasta.

The results indicate that the age group has a significant impact on the acceptability of Banana pseudo-stem flour Pasta for both Tuna Carbonara and Filipino-style spaghetti recipes. This implies that different age groups perceive and accept Banana pseudostem flour pasta differently in the context of these two recipes.

According to the study of Maraña E., et al (2023) using banana pseudo stems to make kimchi is acceptable and adds a unique flavor to Asian food and can be a good substitute for traditional Korean kimchi without lowering the dish's acceptability for the senses.

E. Nutritive Value of Banana Pseudo Stem Flour Pasta

Table 8. Report of Analysis on the Nutritive Value of Banana Pseudo Stem Flour Pasta

The table presents the Report of Analysis on the Nutritive Value of Banana Pseudo Stem Flour which provides detailed on the nutritional content of a sample described as Banana Pseudo Stem Pasta.

| Sample Code | Sample Description | Test | Result |
|-------------|---|----------------------|--------|
| CHE-0277 | Banana Pseudo Stem Pasta Placed in a Vacuum Pack, five packs, 260 grams each, with seal and no label | Ash, % w/w | 0.70 |
| | | Carbohydrate, % w/w | 23.53 |
| | | Crude Fat, % w/w | 0.76 |
| | | Crude Protein, % w/w | 3.95 |
| | | Moisture, | 71.74 |
| | | Energy, kcal | 119 |

F. Shelf-life of the Banana Pseudo Stem Flour and Pasta

a. Shelf life of Banana Pseudo Stem Flour

After grinding the dried banana pseudo stem it is then stored in a polyethylene plastic sealed with a vacuum sealer and kept in a room temperature.

| | Observation and Remarks |
|--------|--|
| Day 1 | The banana pseudo-stem flour had a perfect appearance and aroma |
| Day 15 | The banana pseudo-stem flour still had a perfect appearance and aroma |
| Day 30 | The banana pseudo-stem flour still had a perfect appearance and aroma |
| Day 45 | The banana pseudo-stem flour still had a perfect appearance and aroma |
| Day 60 | The banana pseudo-stem flour still had a perfect appearance but the aroma was |
| | slightly off. |
| Day 75 | The banana pseudo stem flour becomes clumpy but the color remains the same and |
| | the aroma becomes rancid. |

The study found that the shelf life of banana pseudo stem flour is 45 days, after which the aroma deteriorates and is slightly off at 60 days. Even though no mold has been found, there is a rancid aroma in the flour.



Figure 6. Banana Pseudo Stem Flour at Day 75

b. Shelf-life of Banana Pseudo Stem Pasta

After making the banana pseudo stem flour pasta, the researcher put them in a polyethylene pouch sealed in a vacuum sealer and kept in a room temperature.

| | Observation and Remarks |
|-------|---|
| Day 1 | The banana pseudo stem flour pasta had a perfect appearance, taste, aroma, and texture. |
| Day 2 | The banana pseudo stem flour pasta was still good, no molds in the pasta. |
| Day 3 | Molds started to proliferate in the pasta. |



Figure 7. Banana Pseudo Stem Flour Pasta at Day 3

The pseudo stems of the banana turned brown throughout the drying process, giving the pasta its brown color. The color of the banana pseudo stem changes due to enzymatic browning, which can occur without the addition of potassium metabisulfite (Simran, 2018) or any other anti-browning substance.

The shelf life of fresh pasta is affected by its high water content; fresh pasta is easily perishable. (Del Nobile, et al 2009) Both different enzymatic activities and the metabolic activity of microorganisms (bacteria, yeasts, and molds) that can readily proliferate in the product cause it to spoil. Hand-made fresh pasta can last up to 4 to 5 days under refrigerated condition because there is no thermal treatment was applied (Panza, et al 2022). Fresh pasta is recognized for having a moisture content of more than 24.0% and a good nutritional profile. But, in some situations, pasta might serve as a perfect medium for the growth of microorganisms, thus preservatives must be added to extend its shelf life. To extend the shelf life, careful consideration has been given to the choice of technology that will be used during production, packing, and storage (Tashim, et al, 2021). Fresh pasta must be stored in a refrigerated environment. In certain situations, vacuum packing changed atmospheres, and the inclusion of chemical preservatives may also be required for preservation. (Del Torre et al, 2004, Sanguinetti, et al 2016).

CONCLUSION

In view of the above findings, the study arrived at the following conclusions:

- 1. Based on the findings of the study, the banana pseudo stem flour is acceptable as an alternative flour to pasta making as perceived by the respondents among various groups.
- 2. The pseudo stem pasta made from bananas is a low-fat, low-protein dish with a moderate carbohydrate content, high moisture content, and 119 calories per serving. This study suggests that banana pseudo-stem pasta is a safe, pleasant, and beneficial food for humans to consume.
- 3. Both tuna carbonara and Filipino-style spaghetti pasta recipes are positively accepted by the respondents in terms of aroma and taste. Regarding appearance, respondents generally agreed that the product prepared with pseudo-stem flour pasta from bananas is appetizing, tasty, and equivalent to other pasta
- 4. The study also reveals that the acceptability of Banana Pseudo Stem Flour Pasta for Filipino-style spaghetti and Tuna Carbonara dishes is significantly influenced by the age group of respondents. This suggests that, within the context of these two recipes, various age groups will see and accept banana pseudo-stem flour pasta in different ways.
- 5. Further research is still necessary to improve the existing product. Thus, this study offers a feasible approach for the productive and simple utilization of banana pseudo-stem waste.

RECOMMENDATIONS

In the light of the foregoing findings and conclusions, the researcher recommends the following:

- 1. Methods to extend the shelf life of the banana pseudo stem pasta be explored. The use of stabilizers or other preservation techniques to increase the shelf life of confections.
- 2. Pasta made with banana pseudo stems should be cooked to the desired recipe the day it is produced for optimal quality.
- 3. Homemakers, professionals, and students are encouraged to explore the banana pseudo-stem flour in making pasta and noodles.
- 4. Future researchers and researchers are encouraged to use banana pseudo stem flour in pasta making to improve its quality and nutritional content.
- 5. Similar studies must be made for its marketability and profitability.
- 6. Further research is needed to improves the products' storability and to lessen its moisture content.
- 7. Future research must look into other possibilities of using other varieties of banana pseudo stem in making banana pseudo stem flour pasta.
- 8. To raise consumer awareness and demand, educational campaigns should be conducted to promote the nutritional benefits of banana pseudo stem flour as well as the sensory appeal of the items manufactured with it.

COMPLIANCE WITH ETHICAL STANDARDS

The authors hereby declare that the study was carried out in complete accordance with ethical standards, all participants received written informed permission explaining that their participation is optional, that their personal information would be kept confidential, and that they will be kept anonymous. The freedom to leave the study at any moment and without consequence was explained to the respondents. There is no conflict of interest in the way this study is being conducted. The writers have taken great care to avoid plagiarism and have made sure that all of their sources are correctly credited. Additionally, there was no prejudice in the interpretation of the results, and they were only used for study.

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